

## X-Ray Topography of a 540R-SiC Lely Platelet

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Beamline(s): X19C

**Introduction:** Giant polytypes of Silicon Carbide with a variety of long-repeat distances appear in the literature. Most recorded instances occur in small crystals as narrow lamellae sandwiched between layers of more common, syntactically related polytypes<sup>1</sup>. This crystal is unusual because of its large size (14mm in its longest dimension), and that it seems to be polytypically pure.

**Methods and Materials:** Topographic images were recorded on Kodak Industrex SR-5 X-ray film at a specimen-to-film distance of 10cm in the transmission and back-reflection geometries.

**Results:** Synchrotron white-beam x-ray topography was performed on a silicon carbide Lely platelet of the polytype 540R in both the back-reflection and transmission geometries. The closely spacing of the spots in this crystal's Laue pattern limited the reflections useful for topography to those whose close neighbors were structurally extinct. Figure 1 shows a topograph recorded from the crystal in back-reflection geometry. Groups of large Burgers vector screw dislocations (superscrews) can be observed close to the crystal growth nucleation point, which appears to be at the center of the crystal's lower edge. Preliminary calculations indicate that the sum total of the Burgers vectors of all the observed micropipes is between 100 and 200nm. Bundles of nearly straight growth dislocations that lie in the basal plane can be seen in the transmission topograph in figure 2 emanating towards the various growth facets, and curving basal plane dislocation loops that are probably a result of deformation can be observed. The basal plane dislocations appear to be linked to the nucleation point, which is also close to the location of the micropipe groups.

**Conclusions:** A literature study of polytypism in Lely platelets involving 200 samples<sup>1</sup> observed no long-period polytypes in isolation, but invariably found them as lamellae sandwiched between syntactically-coalesced shorter-period polytypes; and that none of the crystals examined contained superscrew dislocations (micropipes) that might have influenced their polytypism. It was concluded that a crystal composed purely of a single long-repeat polytype was a statistical unlikelihood and that polytype content was thermodynamically-determined. The specimen reported here is an exception that suggests that screw dislocation-assisted growth may, in some cases, exert an influence over the purity of long-repeat distance polytypes.

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**References:** <sup>1</sup>G.R. Fisher and P. Barnes, "Towards a Unified View of Polytypism in Silicon Carbide," *Phil. Mag. B*, **61**, 217, 1990.

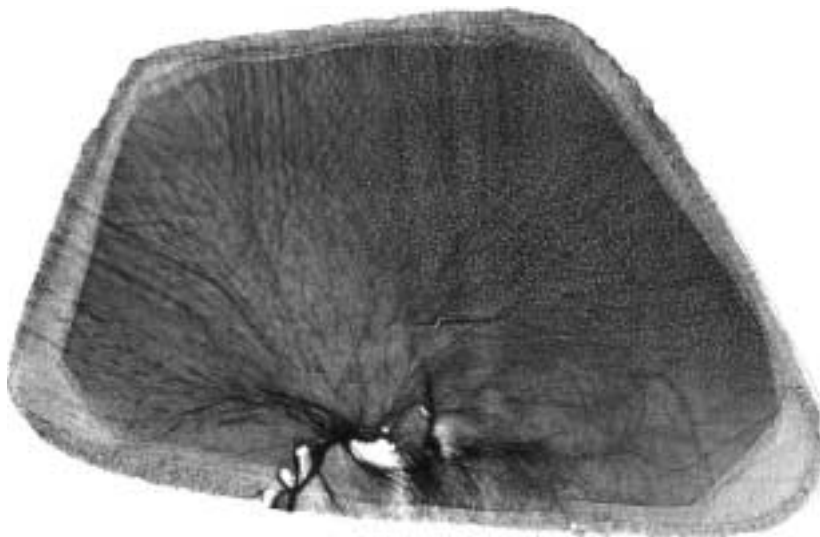


Figure 1. Back-reflection topograph ( $g=000\ 12960$ ,  $\lambda=1.24\text{\AA}$ ).

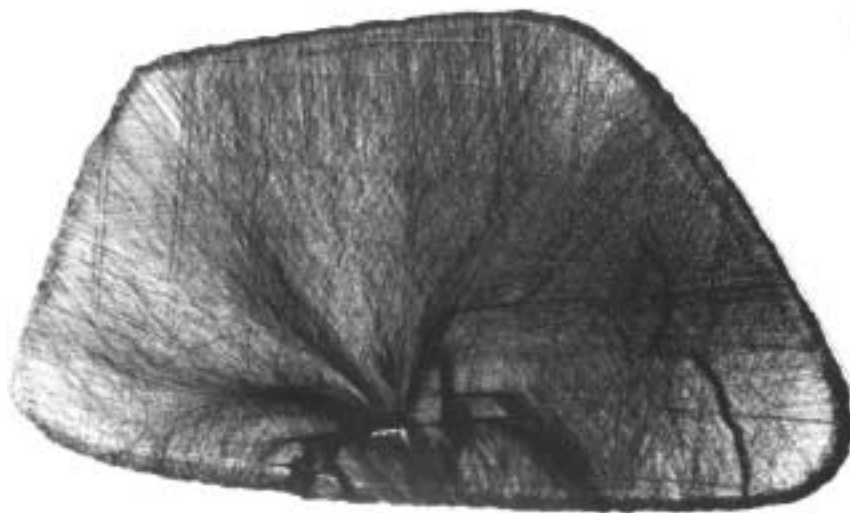


Figure 2. Transmission topograph ( $g=11\bar{2}\ 0$ ,  $\lambda=0.59\text{\AA}$ ).